



Data Acquisition & Data Management

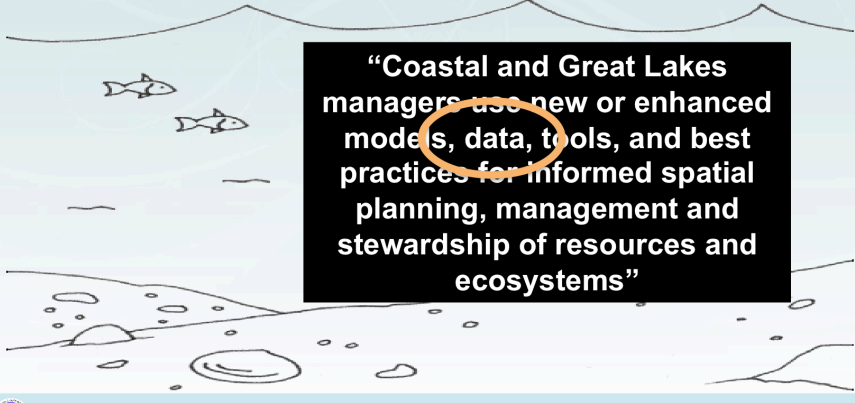
Ronald Muzzi
Electronics Engineer
GLERL's Marine Instrumentation Lab




1

NOAA's Next Generation Strategic Plan

Goal – Resilient Coastal Communities and Economies
Objective – Comprehensive Ocean and Coastal Planning and Management



“Coastal and Great Lakes managers use new or enhanced models, data, tools, and best practices for informed spatial planning, management and stewardship of resources and ecosystems”



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Quality observation data is one of the essential foundations to making informed management decisions.

2

Great Lakes Ecosystem

To best manage the Great Lakes Ecosystem
we need data observations...



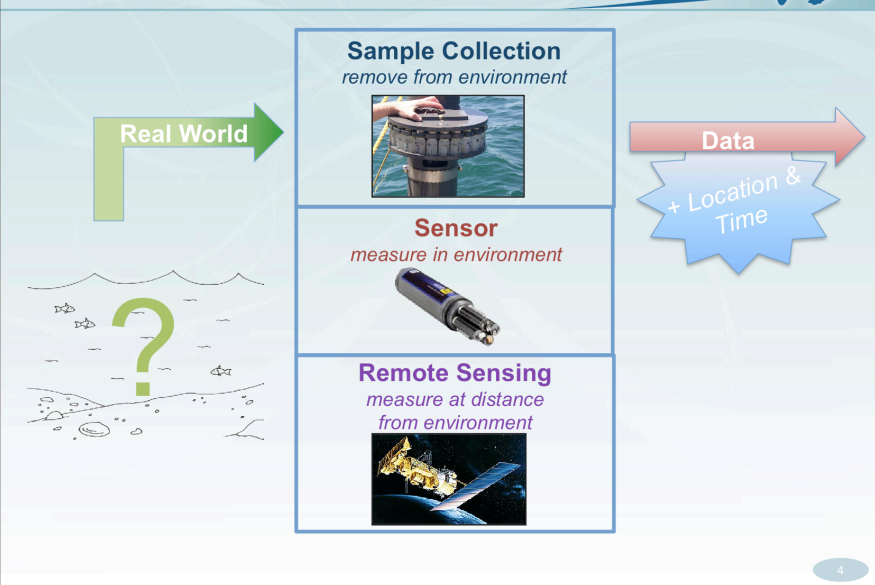
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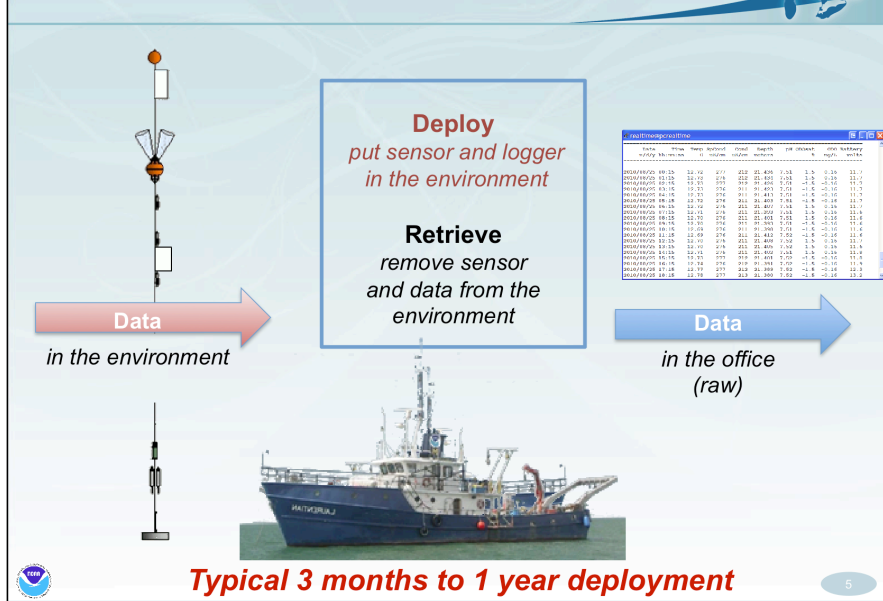
Converting Real World Parameters to Data



4

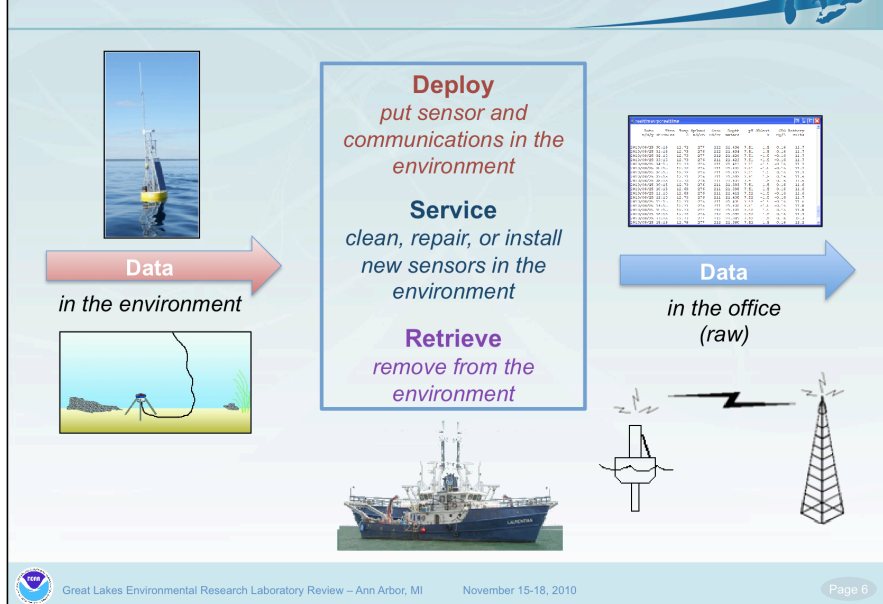
4

Moored Logger Observation Platform

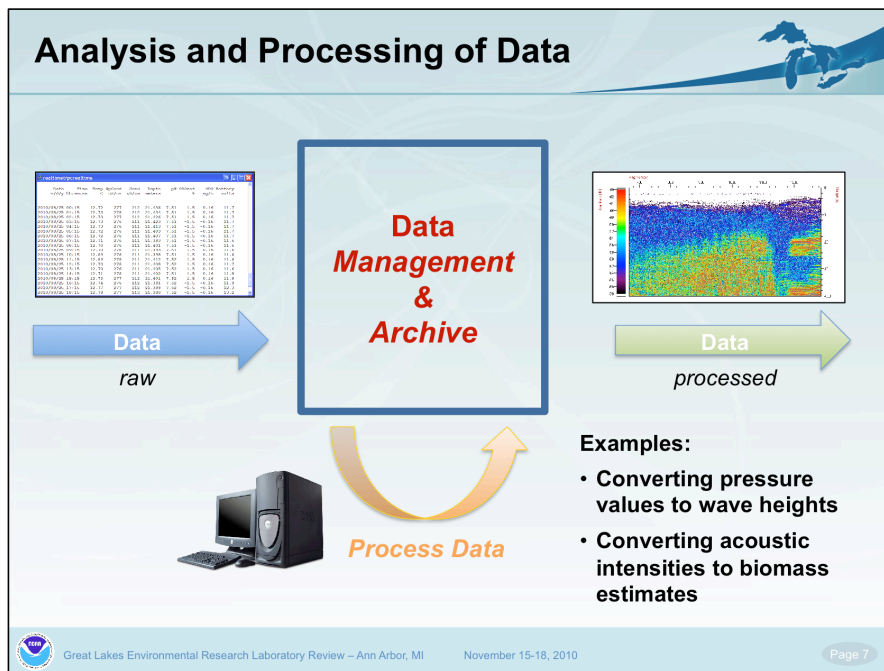


5

Real-Time Observation Platform

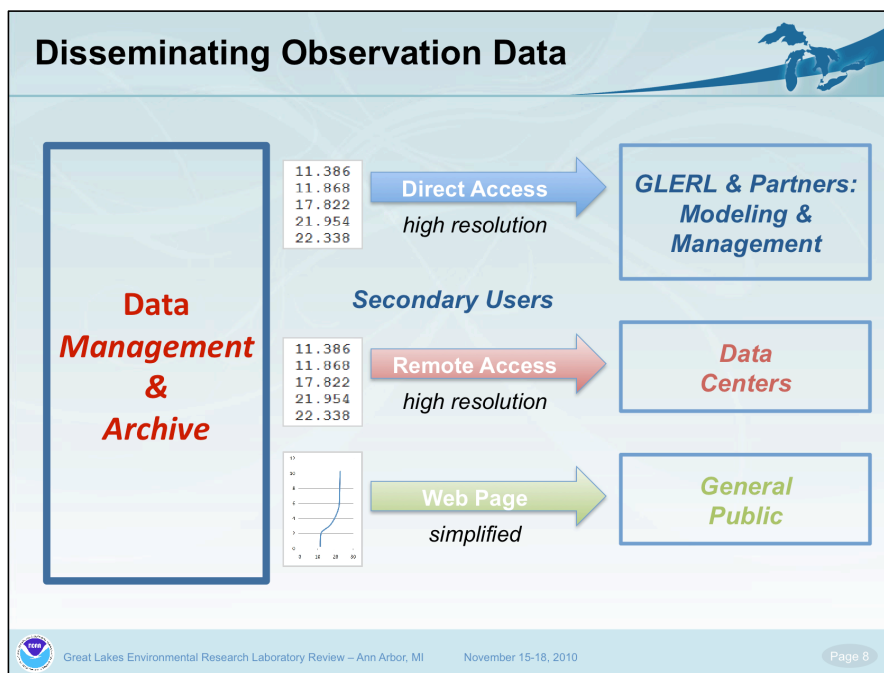


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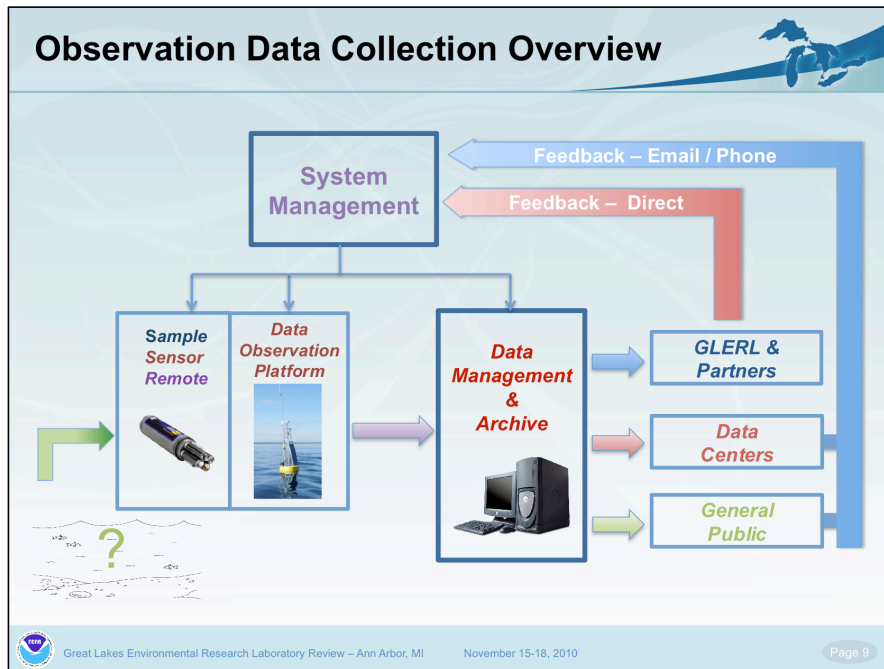


Processing data also includes laboratory processing and analyzing samples collected from the environment. Sometimes samples are processed or partially processed on board the research vessel, sometimes raw samples are brought back to either the Muskegon Field Station or Ann Arbor, or to partner laboratories for processing.

7

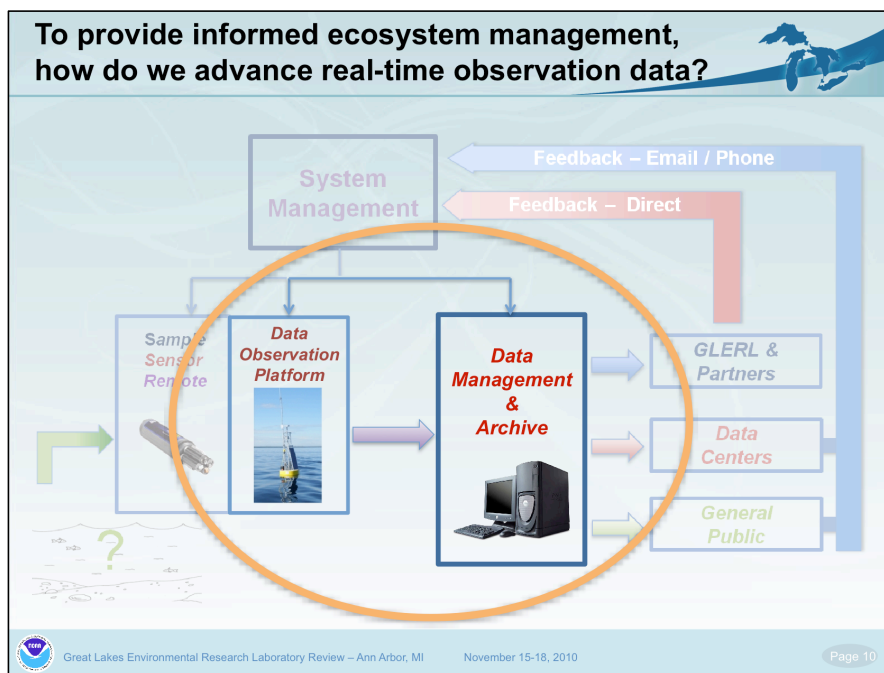


8



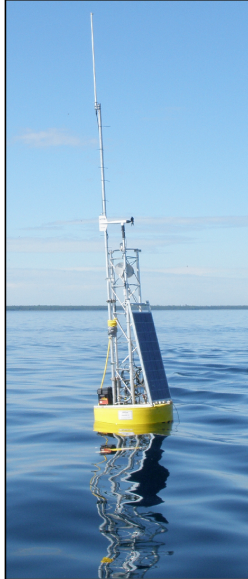
1. System management is a collaborative process, balancing current research needs with available and new instrumentation and including direct feedback from GLERL and its partners.
2. There are many ecosystem data centers that can provide warehousing, dissemination, and archiving of data, but **GLERL is in the unique position** with its infrastructure, expertise, and long-term commitment to be able to **provide the frontline data collection**.

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Real-time Coastal Observation Network



ReCON Project Parameters

High bandwidth, bi-directional, real-time communications to the seafloor

Easy-to-deploy, flexible platform

- Buoys
- Navigational structures
- Piers

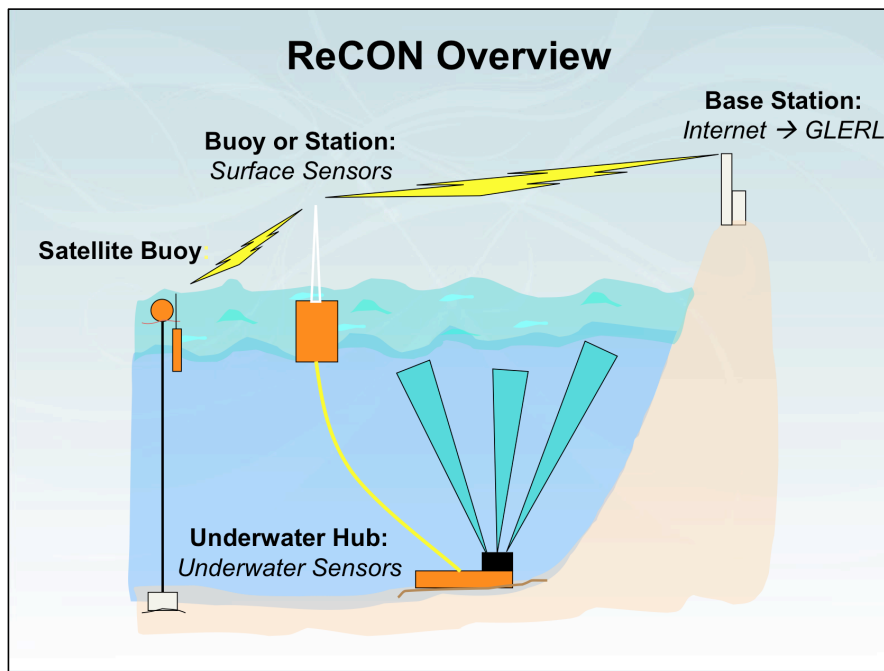
Off-the-shelf components

- Leverage state-of-the-art technology
- Cost savings
- Efficient upgrades

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ReCON buoys and stations were designed and constructed in GLERL's MIL (Marine Instrumentation Laboratory), using CAD circuit and layout design, electronics assembly and trouble-shooting benches, light-duty machine shop for custom fabrications, and the high bay area for buoy assembly and testing. Though our goal is to use as many off-the-shelf components as possible, there are still components of the system which require custom building.

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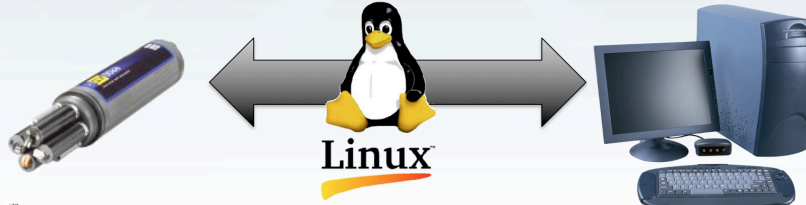
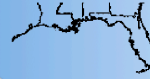
12

ReCON Advanced Technology

Linux General Purpose Operating System

- Mission versatility
- In-situ development
- MBARI SIAM: java-based plug-and-play instrument interoperability protocol
- Diagnostic tools
- Secure, encrypted access

Example:
Florida Keys
Hydrocarbon
Sensor



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MBARI = Monterey Bay Aquarium Research Institute

SIAM = Software Infrastructure and Applications for MOOS (Monterrey Ocean Observing System)

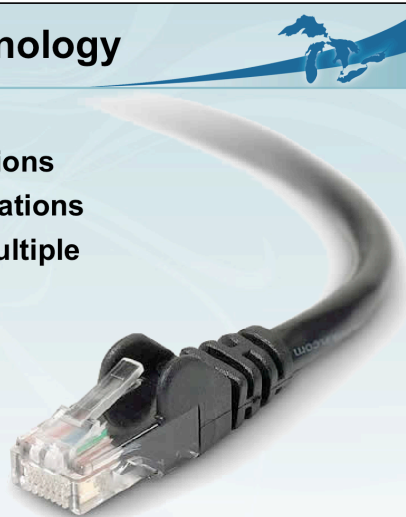
The SIAM system is still in development by MBARI, but what is available now could be adapted to the ReCON network to make most sensors plug-and-play. However, with the continuous advancing of technology, it would not eliminate the need for the development work of integrating new sensor technology.

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ReCON Advanced Technology

Ethernet Backbone

- High bandwidth communications
- Bioacoustic and video applications
- Multiplexing = concurrent, multiple sensor measurements



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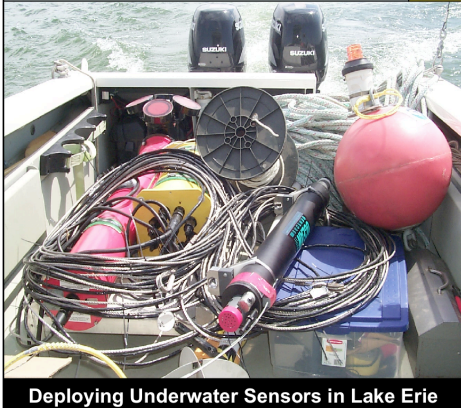
The Florida Keys station is a prototype providing real-time bioacoustics and video, which is being done in collaboration with AOML (Atlantic Oceanographic and Meteorological Laboratory), Keys Marine Lab (Florida Institute of Oceanography), and the University of Miami.

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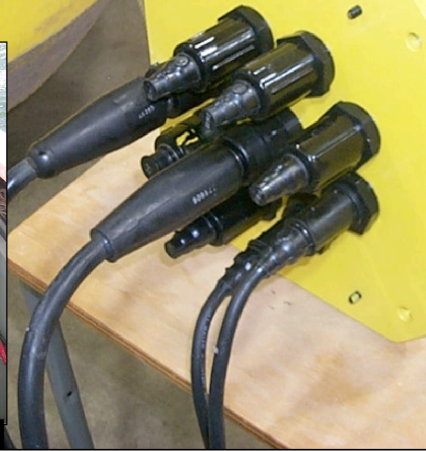
ReCON Advanced Technology

Generic Interface Ports

- Supports any sensor
- Mid-mission deployments



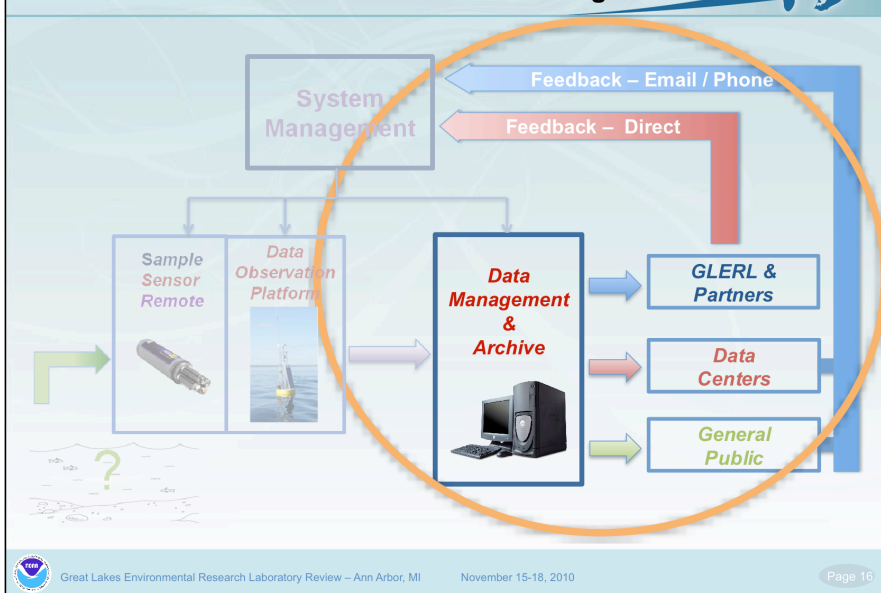
Deploying Underwater Sensors in Lake Erie



Example: Optical sensors, which are vulnerable to fouling, may be added to an already-deployed system in August to study late summer events. This keeps the sensor out of the environment and clean until it is really needed.

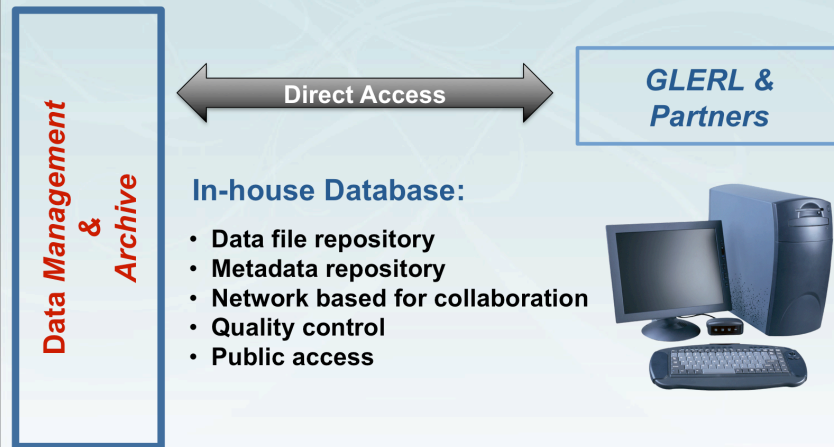
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To provide informed ecosystem management, how do we advance observation data management?



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Observation Data to GLERL and Partners




GLERL Observation Databases

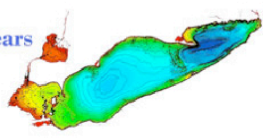
- Real-time Coastal Observation Network Data
- Meteorological Observation Network Data
- International Field Years on Lake Erie Data (IFYLE)
- Saginaw Bay Multi-Stressors Data
- Episodic Events Great Lakes Experiment Data (EEGLE)
- Great Lakes Coastal Forecasting System Data




National Oceanic and Atmospheric Administration
Great Lakes Environmental Research Laboratory



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International Field Years
on Lake Erie
IFYLE


IFYLE Data Search Form

Ship Name

Cruise Type

Description of Cruise Types

Month

Day of Year

Calendar

Station

Station Information
| [Map of Stations](#)
| [Station List](#)

Data Type

List of Available Data Types

Activity

List of Activity Codes


Olog Number


Metadata | Cruise Ops Master Files

Search

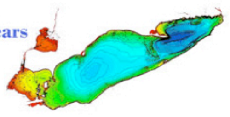
Clear

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Great Lakes Environmental Research Laboratory



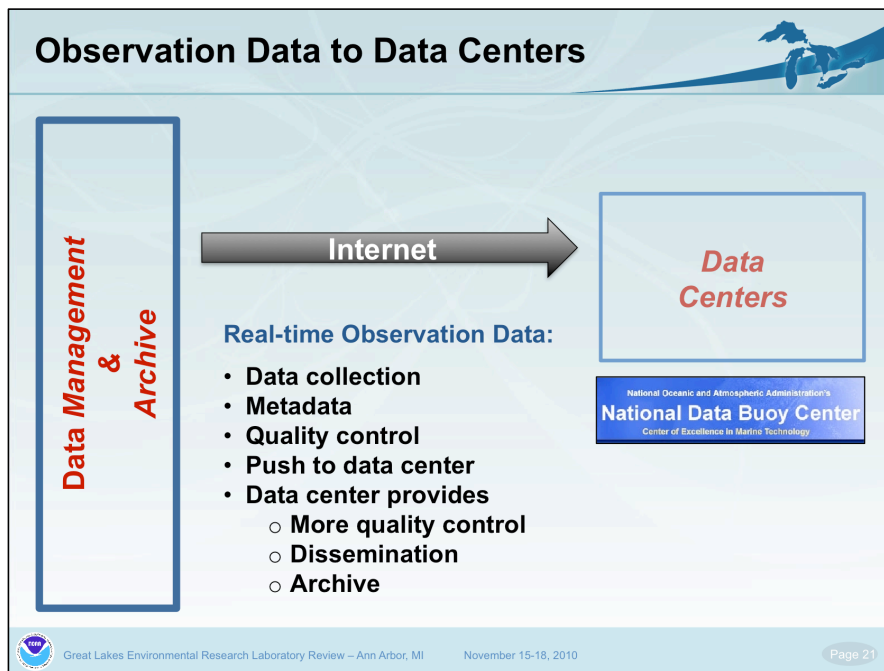
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International Field Years
on Lake Erie
IFYLE


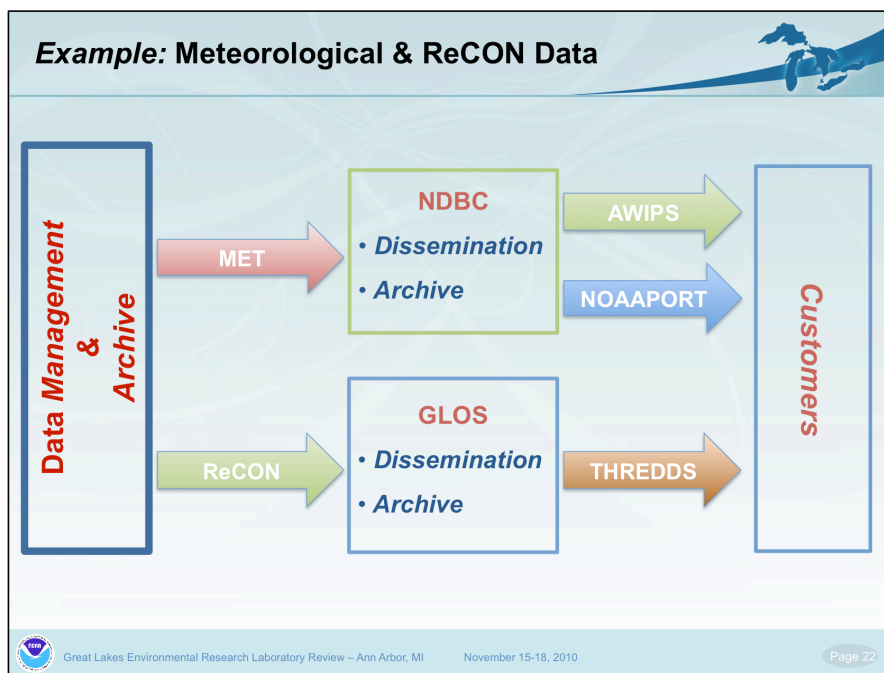
IFYLE Data Search Results

Olog Number	Ship	Cruise Type	Date	Day of Year	Station ID	Activity Code	Local Time	GMT Time	Depth	Latitude	Longitude	Comments	Available Data
GD2005138.01	Lake Guardian	Diel	5-18-2005	138	BW	CTD (Vertical CTD cast)	200	800		41 57.951	81 43.289		CTD
GD2005138.06	Lake Guardian	Diel	5-18-2005	138	BE	CTD (Vertical CTD cast)	600	1000		41 57.964	81 38.663		CTD
GD2005138.12	Lake Guardian	Diel	5-18-2005	138	BW	CTD (Vertical CTD cast)	1000	1400		41 57.929	81 43.414		CTD
GD2005138.18	Lake Guardian	Diel	5-18-2005	138	BE	CTD (Vertical CTD cast)	1415	1815		41 57.947	81 38.687		CTD

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NBDC – National Data Buoy Center

AWIPS – Advanced Interactive Processing System

AWIPS & NOAAPORT feed the NWS (National Weather Service) offices.

GLOS – Great Lakes Observing System

THREDDS – Thematic Real-time Environmental Distributed Data Services

A THREDDS server provides an efficient way for an investigator to select and process data over a selected geographic region and time frame without regard to the origin of the data and without the need to download the data. The data is used efficiently and quickly over an internet connection via libraries included in the investigator's software.

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Observation Data to General Public

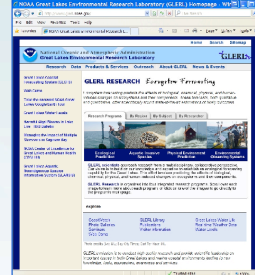
**Data Management
&
Archive**

Web Server

**General
Public**

Publicly Accessible Data:

- Simplified for public level
 - Data
 - Metadata
- Web-based
- Searchable (world wide)
- E-mail / phone feedback

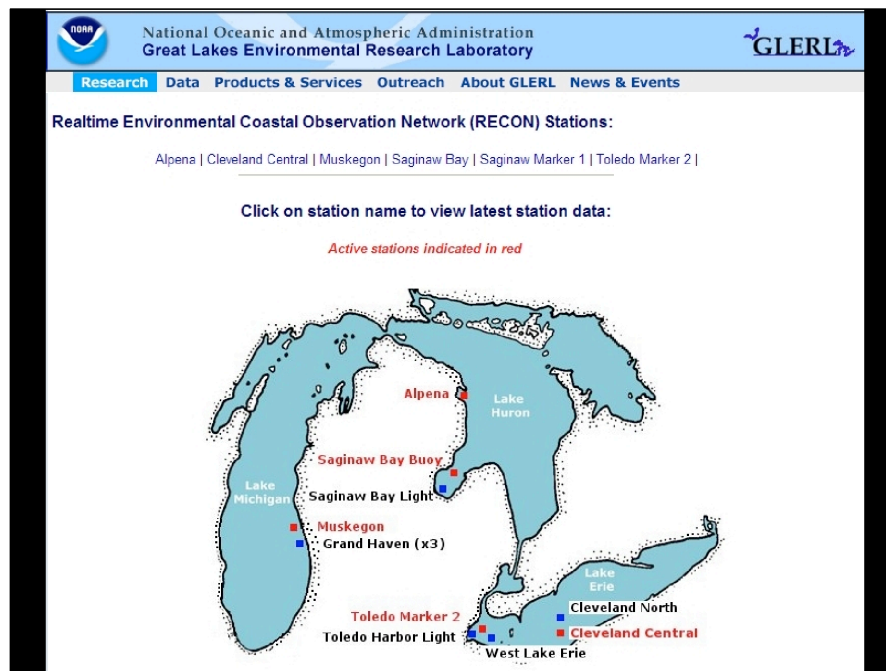


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Partners / Customers



Federal:

- GLERL Scientists
- AOML – Atlantic Oceanographic and Meteorological Laboratory
- NASA Glenn Research Center
- NDBC – National Data Buoy Center
- NWS – National Weather Service
- NOS TBNMS – National Ocean Service / Thunder Bay National Marine Sanctuary
- U.S. Coast Guard – Ninth District

Organizations:

- Keys Marine Lab SEAKEYS (Sustained Ecological Research Related to Management of the Florida Keys Seascape)
- Integrated Coral Observing Network
- GLOS – Great Lakes Observing System
- IOOS – U.S. Integrated Ocean Observing System
- Lake Carriers Association

Academic:

- University of Michigan: CILER – Cooperative Institute for Limnology and Ecosystems Research
- University of South Florida: FIO – Florida Institute of Oceanography
- Ohio Universities: OSC – Ohio Supercomputer Center
- University of Toledo: Lake Erie Center
- University of Wisconsin / Milwaukee : GLWI – Great Lakes Water Institute

Community:

- Ann Arbor Hands-On Museum
- Chicago Museum of Science and Industry
- City of Cleveland Division of Water
- Milwaukee Community Sailing Center

The General Public



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Our ReCON station in western Lake Erie provides early detection of HABs (Harmful Algal Blooms) through both in-situ sensors and webcam images. The Lake Erie Center then uses this information to conduct intensive sampling during the event.

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Real-time information from GLERL is used in the managing of commercial vessel traffic in the Great Lakes.

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Partners / Customers

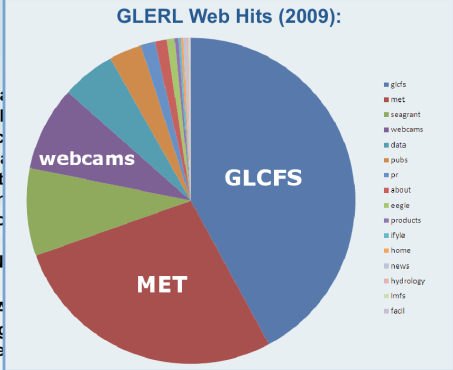
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GLERL Web Hits (2009):



The General Public


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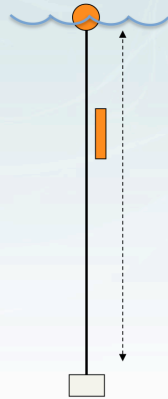
Last year (2009), the Great Lakes Coastal Forecasting System (GLCFS) received the most web hits, followed closely by the MET (Meteorological) stations and the webcams (part of the MET stations).

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Future Projects

Great Lakes Profiler

*Robust & economical for
profiled time series observations*



Updating Former Databases

*Cataloging data sets and metadata
to state-of-the-art technologies*



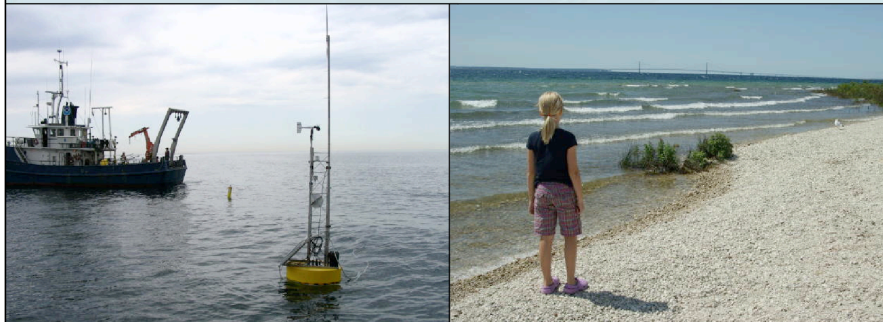
More Data Dissemination

All ReCON and other data to GLOS

Date m/d/y	Time hh:mm:ss	Temp C	SpCond uS/cm	Cond uS/cm	Depth meters	pH	CDOMat %	OD0 mg/L	Battery volts
2010/08/25	00:15	12.70	277	210	21.436	7.61	-1.5	-0.16	11.7
2010/08/25	01:15	12.70	276	210	21.434	7.61	-1.5	-0.16	11.7
2010/08/25	02:15	12.70	277	210	21.436	7.61	-1.5	-0.16	11.7
2010/08/25	03:15	12.70	276	211	21.403	7.61	-1.5	-0.16	11.7
2010/08/25	04:15	12.70	276	211	21.413	7.61	-1.5	-0.16	11.7
2010/08/25	05:15	12.70	276	211	21.403	7.61	-1.5	-0.16	11.7
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2010/08/25	07:15	12.71	276	211	21.393	7.61	-1.5	-0.16	11.6
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2010/08/25	13:15	12.70	276	211	21.405	7.60	-1.5	-0.16	11.6
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2010/08/25	15:15	12.70	277	212	21.401	7.62	-1.5	-0.16	11.8
2010/08/25	16:15	12.74	276	212	21.391	7.62	-1.5	-0.16	11.9
2010/08/25	17:15	12.77	277	212	21.389	7.62	-1.5	-0.16	12.3
2010/08/25	18:15	12.78	277	213	21.380	7.62	-1.5	-0.16	13.2

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Thank You!



Deploying ReCON buoy in Lake Michigan

My niece viewing the Mackinac Bridge from Mackinac Island, Lake Huron



GLERL designed & fabricated

Reviewing real-time observations

Adding sensor to underwater platform

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